KANSAS CITY TRACKER

INSTRUCTIONS

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Table Of Contents

1.0 GETTING STARTED QUICKLY.. 1
2.0 OPERATING HINTS.. 3
3.0 INSTALLING THE SOFTWARE DISKETTES.. 5
3.1 Files on the KANSAS CITY TRACKER diskette.. 5
3.2 Installing the diskettes... 6
4.0 INSTALLING THE INTERFACE CARD.. 7
5.0 USING THE INTERFACE CARD... 8
5.1 Connecting the LLG01/LLG02 cards to the YAESU/KENPRO 5400/5600.. 8
5.2 Connecting the LLG02 board to other rotor controllers............................ 8
6.0 RUNNING THE INSTALLATION PROGRAM... 9
7.0 LOADING THE DRIVER AND STATUS POP-UP INTO MEMORY................................ 10
8.0 THE ROTOR DRIVER PROGRAM DRV.COM.. 11
9.0 THE STATUS POP-UP PROGRAM OSC.COM... 15
10.0 THE CONTROL PROGRAM MOVENOW.COM.. 18
11.0 THE CONTROL PROGRAM BBSROTOR.COM... 19
11.1 Program Description... 19
11.2 Azimuth-List Parameter File... 21
12.0 THE APPLICATION PROGRAM DEPH.COM... 21
13.0 THE APPLICATION PROGRAM LEPH.EXE... 21
14.0 THE APPLICATION PROGRAM SCANCODE.COM... 22
15.0 THE APPLICATION PROGRAM TEST.EXE... 22
16.0 THE APPLICATION PROGRAM TTTEST.EXE... 22
17.0 THE APPLICATION PROGRAM POINT.EXE.. 23
18.0 USING AMSAT/N4HY'S QUIKTRAK PROGRAM (VERSION 3.2)............................... 24
19.0 USING GRAFTRAK.. 27
20.0 USING YOUR OWN INTERFACE PROGRAM.. 29
Appendix A: I/O Port Address Table.. 30
Appendix B: Interface Connector Pinouts... 32
Appendix C: Using the "ROTOR INTERFACE OPTION"....................................... 34

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1.0 GETTING STARTED QUICKLY

This document presents a tremendous amount of information for the technically oriented user. This section of the manual provides a fast method of getting your KANSAS CITY TRACKER hardware and software "on the air". I'll assume you can use the normal defaults as 95% of our customers can. If this "quick" setup doesn't work for you, read the rest of the manual and give us a call if you can't sort out your problem. You must be using DOS version 2.00 or higher.

1) Set the dipswitches on the PC interface card numbered from 1 to 8 to OFF-OFF-OFF-OFF-OFF-ON-ON-ON, respectively. On some switches OFF is labeled "open" and ON is labeled "closed". If your card has two dipswitch packages side-by-side, use these settings for the package on the left (viewed with the component side toward you and the card's gold-plated edge-connector down). Right Dipswitch Pack (if present): Set switches 1-6 OFF. Set switch 7 OFF if serial port A will be connected to a Kenwood radio at TTL levels, otherwise set it ON. Set switch 8 OFF if serial port B will be connected to a Kenwood radio at TTL levels, otherwise set it ON. If you're not sure at this point of how to set 7 & 8, preset them ON for now. More details are provided in the KC Tuner manual's radio-connections appendices.

2) Install the card into any slot of your PC. SCREW IT IN. If the end of the edge connector farthest from the DB25 interface connector wants to lift up out of the connector on the motherboard, remove the card, bend the top edge of the metal bezel AWAY front the card about 1/4 inch, and re-inset the card. Make sure you replace and tighten the bezel mounting screw!

3) If you haven't ordered our interface cable, build the interface cable.

4) Connect the interface cable to the PC interface card but NOT to the rotor controller. SCREW THE CABLE ONTO THE INTERFACE CARD NOW! You can save yourself a lot of odd problems later by making sure the connectors are SECURELY fastened together now!

5) Take out all TSR's from your AUTOEXEC.BAT file. Reboot your machine. Put the KANSAS CITY TRACKER diskette into your A: diskette drive.

```
Type:     A:          <--- set your default drive to A:
          INSTALL     <--- run the install program, placing the
                           ROTOR.DAT file onto the diskette.
```

6) After the INSTALL program completes, create a directory called KCT and copy the contents of the KANSAS CITY TRACKER diskette to this directory.

7) Edit your AUTOEXEC.BAT file and add these commands:

```
CD\KCT
DRV/local=-4
OSC/hot=$18
CD\
```

NOTE: The command-line parameters are described in the DRV.COM and OSC.COM sections. If you have a LLG02B- version card that has the rotor interface option installed, add /RIO=1 to the DRV command line. The /LOCAL= parameter defines the difference between your PC's time and UTC (in hours). The above example is valid if your PC is set to Eastern Daylight Savings Time. We recommend you maintain your PC on UTC (/LOCAL=0). If you have to run SETCLOCK or a similar program in your AUTOEXEC.BAT file to set your PC's time, place the commands described above AFTER the command to invoke SETCLOCK.

8) Reboot your system and you're done! The "HOT KEY" for the status pop-up will be ALT-O (the letter O, not the digit zero).

2.0 OPERATING HINTS

This section will contain operating hints and pointers from our test sites and customers. We welcome your comments!

Keep the DB25 connector screwed tightly to the PC-interface card. You'll get some very odd problems if it works loose!

Keep your machine on UTC. Its easy to forget to change the driver's "/LOCAL=n" parameter when you switch to and from daylight saving time! Also, its is very important that your PC's time be accurate. A time difference of one minute can mean many degrees on the high-elevation passes of a low-orbit satellite.

When tracking a low-orbit satellite that will reach a high elevation on its pass, set the time interval in the tracking program to .5 (30 seconds), not the usual period of 1 minute. The elevation and azimith targets change so fast at high antenna elevations that the antenna will lag the satellite without the more frequent updates described here!

Don't reboot your system (using CTL-ALT-DEL) while the rotors are being moved by the driver. The driver will be removed from memory while the rotor will continue moving until the rotor stalls. Even at this point the rotor motor will remain energized. If the driver is loaded into memory in your AUTOEXEC.BAT file the newly-loaded driver will eventually stop the rotor. If you need to reboot your system while the rotors are being moved, first turn off the rotor control box or use the pop-up to disable rotor movement. This does not apply to when you turn your PC off and then back on, as the power-up reset stops all rotor movement.

Several of our customers have 180-degree elevation rotors that (because of the physical installation of the rotors and antennas) must not be moved beyond 90 degrees (straight up). This can be ensured during the installation program by taking the following steps:
1) Whenever the INSTALL program asks you to move the elevation rotor to its highest elevation, move it to 90 degrees.
2) When the elevation rotor is at 90 degrees and the INSTALL programs ask you the degree setting of the rotor, tell them its at 90 degrees.
3) When you are asked to set the OUTPUT VOLTAGE ADJUST level to give a conversion value of 250-254, do so as closely as possible. You may not be able to get the output voltage high enough to reach this level; don't worry about it if you can't. Do NOT try to set the pot so as to give a value of half of 255 (128). This doesn't work!

Several of our customers have had problems with their rotor controllers in the area of the computer control port. These problems let the rotor controller perform normally but interfere with operation when connected to an external controller like the Kansas City Tracker. We have seen situations where the azimuth rotor would move right but not left, and where elevation-rotor movements affected the azimuth position signal. Our boards and cables are fully tested before shipment. If you have problems with the install program or with the operation of your rotor system, please perform the following checks before calling us for help. These steps will help us determine location of the problem, which makes correction of the problem that much faster!

1) Remove the Kansas City Tracker connector from your rotor controller. Move each rotor to the middle of its movement range.

2) Use a wire to momentarily connect the UP, DOWN, LEFT, and RIGHT control inputs to ground. Each input should make the rotor move in an appropriate direction.

3) Connect a voltmeter between the elevation analog output and ground. Moving the elevation rotor should make this voltage change. This voltage should not change when the azimuth rotor is moved.

3) Connect a voltmeter between the azimuth analog output and ground. Moving the azimuth rotor should make this voltage change. This voltage should not change when the elevation rotor is moved.

If your rotor controller passes the tests described above, contact us and we'll help you resolve the problem. If your rotor controller fails these tests, have it repaired.

3.0 INSTALLING THE SOFTWARE DISKETTES

3.1 Files on the KANSAS CITY TRACKER diskette:

READ.ME <--- Release notes
DRVSVC.DOC <--- document describing the interface between the driver (DRV.COM) and other applications programs.
INSTALL.EXE <--- The installation program
ROTOR.DAT <--- The rotor parameter file. A dummy copy is provided. This version should not be used with a real rotor controller.
DRV.COM <--- The TSR rotor driver
OSC.COM <--- The TSR/application rotor-status pop-up
TUNER.COM <--- The TSR radio-tuner driver & tuner-status pop-up
MOVENOW.COM <--- The DOS application program that initiates immediate rotor movements per the commands on the command line.
BBSROTOR.COM <--- The DOS application program that passes the user supplied BBS rotor-movement file to the rotor driver program. See the section on this program for details.
BBSROTOR.DAT <--- Contains 3 examples of user-supplied data files for BBSROTOR.COM
DEPH.COM <--- This program will dump the driver's Time/Target table to a disk file called SAT.LST. This file can be edited using a normal text editer, and can be reloaded to the driver using LEPH.EXE. See the section on this program for details.
LEPH.EXE <--- This program will read tracking data files produced by DEPH.COM (above) and by Silicon Solutions's SEPH tracking program. The data read from these files will be loaded into the driver's Time/Target table. See the section on this program for details.
SCANCODE.COM <--- This program allows the user to determine the keyboard scan code of the key to be used as the status pop-up's hot key.
POINT.EXE <--- This program lets the user supply a station identifier (eg, callsign) and aims the azimuth rotor at the specified station. See the section on this program for details.
TEST.EXE <--- This program lets the user actuate the individual control outputs on the board (both Tracker and Tuner outputs. Also, it can display the position-sensing results.
TTTEST.EXE <--- This handy program creates a simulated OSCAR-10 pass in the Tracker table. See the section on this program for details.

4.0 Installing the diskettes

Copy the software diskettes to your hard disk or to another diskette as soon as possible.

****
*   Copying the diskettes to a hard disk
****

If you have purchased the QUIKTRAK software through us (as written by Bob McGwier N4HY), you'll find this software on the diskette marked "QUIKTRAK SOFTWARE". This software is stored in compressed format (ARC) - the uncompressed software will not fit on a single diskette. This software needs to be unpacked to a high-capacity diskette or better yet to a hard disk. Create a directory and unpack the software by typing the following...

```
C> MD\QUIKTRAK
C> CD\QUIKTRAK
C> A:PKXARC A:DISTRIB
```

The rotor driver software is on the diskette marked "KANSAS CITY TRACKER". This software is not stored in compressed format. Copy this diskette to the KCT directory (see above) as follows...

```
C> CD\KCT
C> COPY A:*.* C:\KCT
```

4.0 INSTALLING THE INTERFACE CARD

SHIPPING NOTES: The switch-protecting heatshrink covering may still be on the dipswitches - remove and discard it before installing the board in your PC. The 25-pin interface connector on the card may have grounding jumpers installed - remove and discard them if present.

The PC interface card should be inserted into an unused slot in your PC or compatible. Its power requirements are small: 150ma at 5v and 7ma at 12v. The dipswitches on the card should be set to an unused I/O address before inserting the card. The dipswitch settings and corresponding I/O port addresses are defined in Appendix A. The interface card occupies 4 consecutive I/O addresses starting at the I/O address specified on the dipswitches. I/O addresses 200-3FF (hex) are generally considered open for use. You'll need to select an address that is not used by other boards in your system. We recommend the use of 3E0 (hex). An good alternate is 1E0 (hex).

The PC and rotor-controller interface to each other using 2 analog and four TTL signals. They share a common ground. When removing power from your equipment, remove power from the rotor controller either before or at the same time as power is removed from the PC.

Note: While a DB25 connector is used for the PC-Card interface, this interface is NOT a parallel or serial adapter interface. Inserting a connector from a printer, terminal, or modem could damage the external equipment, the PC-Card, or your computer!

5.0 USING THE INTERFACE CARD

The KANSAS CITY TRACKER cards are identified by a code etched into the copper of the card. The format of this code is LLGnnr, where "nn" is the card model number and "r" is the card's artwork revision.

The LLG01 board accepts two 0-5vdc analog position inputs. Its control outputs (Left, Right, Up, Down) are open-collector TTL outputs without pull-up resistors.

The LLG02 board also accepts two 0-5vdc analog position inputs. Its control outputs (Left, Right, Up, Down) are either open-collector TTL outputs without pull-up resistors or (if you have purchased the KC TRACKER with the Rotor Interface Option) open-collector 300ma relay drivers. The relay-drivers can not be used with the Yaesu/Kenpro 5400A/5600A/B AZ-EL rotor control box as the pulse-protection diodes will activate the rotors.

5.1 Connecting the LLG01/LLG02 cards to the YAESU/KENPRO 5400/5600 A/B

An interface cable is needed to connect the PC interface card to the YAESU/KENPRO rotor controller. You can build it - the connectors are provided with the rotor controller and with the KANSAS CITY TRACKER interface card. The cable should be made with 8-conductor shielded wire, with the shield grounded at the PC interface-card end only. You can also buy it from us - see our advertisements!

YAESU/KENPRO connector (8-pin DIN)		PC-Card connector (DB25)
1	Vertical analog output	11
2	Right control input	7
3	Up control input	3
4	Left control input	9
5	Down control input	5
6	Horizontal analog output	13
7	Controller Power	N/C
8	Ground	1
N/C	Cable Shield	1

5.2 Connecting the LLG02 board to other rotor controllers

Our LLG02 board can be used to control other rotor control boxes. This board must have been purchased with the "Rotor Interface Option" for this use. See the appendix "USING THE ROTOR INTERFACE OPTION" for connection details. Don't forget to specify the /RIO=1 command line option in DRV.COM if your LLG02B-version-board has this option.

6.0 RUNNING THE INSTALLATION PROGRAM

You must run the INSTALL program supplied with the KANSAS CITY TRACKER. This program calibrates the ELEV/AZIM rotors and sets various options for you. The rotor driver access a parameter file called ROTOR.DAT when the program is loaded into memory. This file is created by the INSTALL.EXE program and contains the various user-defined rotor parameters and limits. A dummy version of this file is supplied on the "SATELLITE TRACKER" diskette. This version is provided so the user can examine the pop-up without having to run the INSTALL batch file. The computer should not be connected to the rotor while the driver is in memory having been loaded using the dummy parameter file as the driver may stall the rotor. To create a customized ROTOR.DAT parameter file, connect the PC <===> Rotor-Control-Box cable to the PC (but not to the rotor control box) and type the following...

```
    C> CD\KCT          <--- or whatever directory name you used
    C> INSTALL
```

You will be prompted for various parameters.

SIDEKICK and some other terminate-and-stay-resident (TSR) programs attempt to retain control of the system's real-time-clock interrupt. TSR PROGRAMS OF THIS TYPE MAY NOT ALLOW THE INSTALL PROGRAM TO WORK CORRECTLY! We recommend that you un-install ALL TSR's (including the KC Tracker TSRs, if present), run the INSTALL program, and then re-install the TSR's, including DRV.COM (and OSC.COM at your option). DRV.COM and OSC.COM do not need to be installed last in the list of TSR's as most TSR's do. DRV.COM must be installed before OSC.COM. SIDEKICK and some others must be installed after DRV.COM and OSC.COM. We recommend that DRV.COM and OSC.COM be installed before all other TSR's to avoid installation conflicts.

We recommend that elevation rotors be installed so that elevation movement is from 0 degrees to 90/180 degrees (whatever your rotor is capable of). You can install the rotor to start from a negative declination if you desire - provide this information to the INSTALL program at the appropriate time.

The rotor driver will not move the elevation rotor beyond 90 degrees unless the FLIP command-line option is set. You can install a 180 degree rotor as if it were a 90 degree rotor. When asked during the install program to move it upward in elevation, don't move it beyond 90 degrees. Adjust the analog position voltage to read as close as possible to 255.

INTERRUPT VECTOR TO BE USED. You should be able to use any software interrupt in the 60-6F (hex) range. We recommend the use of 63 (hex).

7.0 LOADING THE DRIVER AND STATUS POP-UP INTO MEMORY

The rotor driver DRV.COM and status pop-up OSC.COM must be loaded into your PC's memory before use. The specific load commands are detailed in the next two sections. The section provides some general guidance on how to automatically load the driver and pop-up when your system is reset, by executing the program names in your AUTOEXEC.BAT file. NOTE: The default directory must be set to the directory containing the KANSAS CITY TRACKER software, as the driver (DRV.COM) looks for the ROTOR.DAT file in the default directory.

DRV.COM reads a parameter file each time it is installed (whenever your system boots). This file is expected to be in the default directory. We recommend that you copy the SATELLITE TRACKER software diskette into its own subdirectory, and install this program at system boot-up by adding the following to the end of your AUTOEXEC.BAT file:

```
CD\KCT                  <--- or whatever your directory name is
DRV/LOCAL=-5            <--- installs the driver
OSC/HOT=$18             <--- installs pop-up: hotkey is ALT-O
CD\                     <--- return to the root directory
```

8.0 THE ROTOR DRIVER PROGRAM DRV.COM

DRV.COM is the terminate-and-stay-resident rotor driver. For various reasons, DRV maintains an internal date and time standard. If your system's date or time needs to be changed, you must change the date/time and then reboot and reload DRV so that DRV gets the correct and time.

DRV displays all time information in UTC. DRV must be told the number of hours difference between UTC and the computer's time when it is installed. See the "/LOCAL" command-line option below. We recommend you keep your PC set to UTC. If you don't, you'll have to remember to change your driver-load batch file when your local time changes to and from Daylight Savings Time!

When installed DRV.COM uses about 8k of ram plus an additional 27 bytes for each entry in the Time/Target table. The size of this table is set by the user via the "/TT" command-line option (see below).

```
C>DRV command-line-options
```

The driver supports several command-line options. These options let the user modify the operating parameters of the driver as it is installed. Since these options can only be changed when the driver is installed, the system must be rebooted to change these parameters once the driver is loaded into memory.

All of the command-line parameters are identified by a slash ("/") followed by the parameter identifier, an equal-sign ("="), and the value to be used for the parameter. Multiple parameters can be run together or separated by spaces or tabs. If a parameter is not specified the default value is used.

Most of the command-line options use numbers as operands. The normal numbering base is decimal. If the number is preceded with a dollar-sign ("$") the number is processed as a hex number. If the number is preceded with a minus-sign ("-") the number is processed as a negative decimal number.

Parameter	Default	Function
LOCAL	0	Time difference between your PC's time and UTC. On the east coast of the U.S. this is -5 (EST) or -4 (EDST). If your PC runs on UTC this value should be zero.
IO	$3E0	The I/O address set on the dipswitches of your rotor interface card. I/O addresses and dipswitch settings are given in Appendix A.
VECTOR	$63	This is the software interrupt vector used by the various KANSAS CITY TRACKER programs to communicate with the driver.

TT	500	Defines the maximum number of Time/Target table entries allocated by the driver. The maximum value for this parameter is 20000. NOTE: the max value for this entry would occupy over 512k of ram! If you need more table space, try 5000 entries, which only use 130k of ram.
STALL	18	Defines the stall timer length (about 9 units per second).
EW	7	Target elevation window size. The rotor will move to within +/- 5 degrees of the target before stopping. This value is in units of 1.4 per degree. Increasing the value will result in degraded aiming accuracy but less wear on your rotors. The default values are probably the best balance.
AW	3	Target azimuth window size. The rotor will move to within +/- 5 degrees of the target before stopping. This value is in units of about .7 per degree. Increasing the value will result in degraded aiming accuracy but less wear on your rotors. The default value is probably the best balance.
ES	0	Initial elevation slew (overridden by OSC command-line values)
AS	0	Initial azimuth slew (overridden by OSC command-line values)
MA	1	Default morse-annunciator sender status. If set to 0 the morse status sender will be off. If set to 1 the morse sender will automatically announce rotor error status messages and upcoming satellite passes. If set to 2 the sender will also send the rotor positions when movement stops. The initial setting can be overridden from the status pop-up.
MS	1	Morse-annunciator letter sending speed: 1 = 22wpm, 2 = 11wpm, 3 = 7wpm, 4 = 5wpm, 5 = 4wpm. This is the speed at which the actual dots & dashes are sent.

MX	1	Morse-annunciator letter spacing speed: 1 = 22wpm, 2 = 11wpm, 3 = 7wpm, 4 = 5wpm, 5 = 4wpm. This parameter controls the time-spacing of the morse letters. This parameter must be equal to or greater than the /MS parameter.
GT	0	Silicon Solutions' Enable-GT-Interface flag. Set this value to 1 to enable support for Silicon Solutions "GT" program. This program interfaces in real-time to the driver and status pop-up.
ISCP	$67	This parameter defines the interrupt vector number of the first of the two consecutive interrupt vectors used by GrafTrak's TSR interface. The default value of 103 & 104 (67h & 68h) can be changed to another vector pair if the default values are found to interfere with other functions within your PC. We recommend 64h as a starting point if another vector pair is needed.
FLIP	0	The flip option lets you disable the driver's normal procedure of forcing the elevation target to be not above 90 degrees. For tracking programs like the latest versions of GRAFTRAK, that can generate elevation targets greater than 90 degress, this option should be set to 1.
PK	0	Parking delay in minutes. If this option is specified the rotor driver (after LOS, deleting a pass, or clearing the table) will wait the specified time & then move the rotors to the specified park position (see the /PA and /PE options below). The parking timer is stopped and ignored if the driver is disabled.
PA	0	Parking position azimuth (0-359). This parameter can be specified even if the /PK option is not specified. This information can then be used for the "P" pop-up key command.
PE	0	Parking position elevation (0-90). This parameter can be specified even if the /PK option is not specified. This information can then be used for the "P" pop-up key command.

RIO	0	Rotor Interface option flag. If your board has the rotor interface option, set this command-line option to 1. The rotor interface option's presence can be determined by looking at the KCT rotor interface card. If it has 3 ICs with 8 pins each (4 down each size), the option was installed on your card. This option is needed on the LLG02 revision "B" card only.
1AX	0	When this parameter is set to 1 the rotor control logic will not move the elevation and azimuth rotors at the same time. If both rotors need to be moved one of the rotors will hold until the other has stopped before actually moving. This option is only needed where the rotor controller can only power one axis at a time. The Dynetic Systems DR10 is an example of this type of rotor controller. This option also corrects for the high elevation-rotor speed of the DR10.
IAA	1	Initial Antenna Alignment flag. When this flag is set to 1 when loading the driver into memory the driver will move the antennas to the park positions, calibrating the pop-up display at the same time. When this flag is set to 0 when loading the driver into memory the driver will not move the antennas. The status pop-up will show the azimuth and elevation positions as 0. The antennas may not be at this position. This dichotomy will be resolved the first time the driver is asked to move the antennas. This parameter is useful if you don't want the antennas parked when you load the driver into memory. We recommend the default value for normal installations.
DM	0	Date-sequence flag. When set to the default value of 0, dates are displayed in the sequence MM/DD/YY. When set to 1, dates are displayed in the sequence DD/MM/YY.

For Example: `C>DRV /local=-4 /TT=1000 /IO=$3D0`

Places the PC's local time as 4 hours behind UTC, allocates 1,000 Time/Target table entries, and tells the driver the switches on the PC interface card are set to 3D0 (hex).

9.0 THE STATUS POP-UP PROGRAM OSC.COM

OSC.COM is the rotor status display program. It uses about 10k of memory when installed as a TSR. This program shows the time, current ELEV and AZIM positions, the target ELEV and AZIM positions, the operator-set slew displacements, the first few entries on the Time/Target table, and the current rotor status. The program can be installed as a Terminate and Stay Resident (TSR) pop-up or run as an application program. The driver must have been installed for this program to install or run in either mode. When installed as a pop-up the status display window can be pulled up at any time the system display is in text mode; if the display is in graphics mode the pop-up will not come up or the application will terminate. You must supply the scan code of the key to be used as the pop-up's hot-key when you load OSC.COM as a TSR. Any key in any shift state can be used as the hot key (except the shift keys themselves). You can determine the scan code of any key by running the program SCANCODE.COM. A copy of SCANCODE.COM is provided on the KANSAS CITY TRACKER release diskette.

OSC.COM supports several command-line options. These options are supplied using the same format as DRV.COM; see the DRV.COM section for format details.

Parameter	Default	Function
HOT	none	This parameter defines the scancode of the key to be used as the key which invokes the status pop-up. If this parameter is not specified OSC.COM runs as an application and does not load as a TSR.
SHIFT	5	This parameter defines the shift-key state which in conjunction with the specified Hot Key causes the status-pop-up to be invoked. A value of 0 means No Shift Keys pressed 1 " Right shift key pressed 2 " Left shift key pressed 3 " Either shift key pressed 4 " any CTRL key pressed 5 " any ALT key pressed 6 " any CTRL and any ALT key
ES	0	Initial elevation slew (overrides DRV command-line values)
AS	0	Initial azimuth slew (overrides DRV command-line values)

For Example: C>OSC /HOT=$18 (Loads into memory as a TSR; the hot key is ALT-O)

OSC.COM displays the 7 most current Time/Target table entries. If more active entries exist in the driver's table a down arrow is displayed on the last line of the table display. If the application program that supplies this table data has flagged the first and last entries of the satellite pass as documented in DRVSVC.DOC, the OSC pop-up will flag these table entries in its display with a leading "F"irst or "L"ast as required, and display the satellite's name. The F3 and F4 keys can be used to move the Time/Target table display forward (F3) or backward (F4).

When the KC Tracker is operating in BBSROTOR mode (when Mode=BBSROTOR - see the BBSROTOR program for details) the display will automatically place the current table entry at the center of the table display. This BBSROTOR-mode "auto centering" function remains active at all times. If F3 or F4 are pressed the display will move to the requested table entries and remain there until moved again by the operator OR until the next table entry becomes current. When the next table entry becomes current the display will return to "auto centering" mode. Please note that this entire paragraph only applies to the KC Tracker when operating in BBSROTOR mode.

Conversion errors of up to 2 degrees are introduced in converting the rotor position information for display in OSC. When the rotor is stopped these conversion errors are eliminated by the software. When the rotor driver is disabled using the "T" command the CURRENT positions are displayed with the conversion errors in place to maximize the display update speed. Expect the CURRENT display to be as much as 2 degrees off when the driver is disabled.

The absolute maximum values for elevation range from -90 to +270. The absolute maximum values for azimuth range from 0 to 359. These values are also limited by the position-values entered at the movement extremes during installation. Negative elevation values can be entered in the OSC.COM target-change by entering a leading minus sign ("-") when typing the elevation value. The minus-sign can be cleared by typing a plus sign ("+"). Both the minus key and plus key cause the working value to be cleared to zero.

The pop-up provides access to the driver's "SLEW" parameters. The elevation and azimuth slew parameters are values (in degrees) that are added to the elevation or azimuth position readings before processing these readings in the driver. These parameters can be used to ajust a rotor system that is not installed exactly correct or has been changed (eg, by high winds bending the antenna). These values are "clamped" at the installed limits in degrees. For example, if the elevation rotor was installed to stop (DOWN) at 0 degrees the target is set to 0 degrees and the slew is set to -5 degrees, the elevation rotor will stop at 0 degrees and will not try to go to -5 degrees. In this situation, the rotor will not move until the target elevation excedes +5 degrees. Once the elevation target excedes +5 degrees the rotor will track the satellite normally.

The status pop-up displays the current setting of the morse-annunciator option. The field is called "Morse=' and is in the upper left of the status window. Note that the antennas are pre-aimed (and the radios are pre-tuned if you are using the KC Tuner) at the 1-minute warning and at the start of the pass. The <F5> key is used to flip this option among the various options. The options are:

1) "OFF"	Send no CW announcements
2) "Pass&Err"	Sends 3-minute ("3 3 3"), 2-minute ("2 2 2"), 1-minute ("1 1 1"), & start-of-pass (rapid trill) warnings before a satellite pass. Also sends rotor status if a rotor stalls ("EL STALLED AZ nn").
3) "ALL"	Adds to the "Pass&Err" a CW announcement of the rotor positions when both rotors stop ("EL nn AZ nn").

The <F6> key can be used to solicit the CW rotor status and position announcement at any time, even if the morse-annunciator option is set to off. The CW sending speed and spacing are controlled by the driver (DRV.COM) command line options /MS and /MX.

The TAB key can be used at any time to change the elevation and azimuth target positions. This feature is useful when you want to ask the PC to move the rotors to a particular position. The P key can be used at any time to force the rotors to the parked position. The X key can be used at any time to empty the Time/Target table and force the table mode back to normal (from BBSROTOR). The parking timer will automatically be started. The S key can be used at any time to remove the current pass (if there is one, or the next pass if there is not) from the Time/Target table. The table handler must be in normal mode. The parking timer will automatically be started.

10.0 THE CONTROL PROGRAM MOVENOW.COM

MOVENOW.COM is a DOS application program (not a TSR program). This program can be used to set the driver's target elevation or azimuth positions (or both) and optionally wait for the indicated movement to cease. This function is useful for DOS programs such as BBSs that want to command antenna movement without using the service interrupts. These programs can "SHELL" to MOVENOW.COM using the command-line parameters described below.

This program was specifically written to allow packet operators to use directional antennas to automatically forward packets on a regular basis (for example, hourly).

Command line format:

```
    C>MOVENOW  [PA aaa]  [PB bbb]  [PW]
```

Where...

aaa - azimuth position, 0-360 degrees

bbb - elevation position, 0-180 degrees

PW - this command option tells MOVENOW to wait until rotor movement stops before returning to DOS.

In the example above, the left and right brackets ([&]) are used to indicate that the operand contained within the brackets is optional and need not be supplied. In any case, do not type the brackets.

11.0 THE CONTROL PROGRAM BBSROTOR.COM

11.1 Program Description

The DOS application program BBSROTOR.COM is supplied for use by BBS operators who use directional antennas. This program places the rotor driver program into a special mode wherein it repeats a specified list of azimuth movements, stopping for a specified period of time at each azimuth setting. The elevation target is defaulted to zero and can not be changed.

For example, you might want to aim at remote site "KB2CST" at 97 degrees azimuth from hour+5 thru hour+9, at remote site "KC2TN" at 283 degrees azimuth from hour+35 thru hour+39, at remote site "N4HY" at 43 degrees azimuth from hour+40 thru hour+44, and at all other times at remote site "WB2MNF" at 14 degrees azimuth. The remote packet sites can be programmed to forward mail to you at the appropriate time each hour.

Command Format: `C> BBSROTOR filename.ext`

In the command-format description shown above, the field "filename.ext" is the name of the parameter file you create. The filename and extension are required by BBSROTOR; the program will abort if these parameters are not supplied.

11.2 Azimuth-List Parameter File

BBSROTOR reads a parameter file that you must create. This file is in text-file format and can easily be created and modified with a text edit program. EDLIN, the edit program supplied with DOS, can be used for this purpose.

The first line of the azimuth list file contains only the time period of the repeated movement cycle. This time period is expressed in d/hh:mm format where d is the number of days (0, 1, or 7), hh is the number of hours (0-23), and mm is the number of minutes (0-59) In the example above this would be 0/1:00. BBSROTOR can handle a cycle period of seven days or any period of time (in hours and minutes) up to and including 24 hours (1 day). The repeating periods are assumed to start at midnight of the day BBSROTOR was run (except the 7-day cycle, which will automatically align itself to the correct day of the week). The day and hour are optional depending on the cycle duration.

Each line after line #1 of the azimuth-list file contains the starting time of the time segment in d/hh:mm format (relative to zero - the first minute of the cycle is minute 0), the azimuth position for this segment and an optional 0-10 byte text string for use as a segment identifier. The starting time and azimuth must be supplied. Fields must be separated with spaces or tab characters. We recommend the use of tabs to keep the columns lined up and readable. The starting time is expressed in a d/hh:mm format different from the cycle period duration. Here, "d" represents the day of the week from this list of abbreviations: MON, TUE, WED, THU, FRI, SAT, SUN. The day code and slash ("/") divider are optional. "hh" represents hours (0-23). The hour value and colon (":") divider are optional if the day value is not specified. "mm" represents minutes (0-59). Legal formats are: D/HH:MM, HH:MM, and MM.

Empty lines are ignored. Semi-colons (";") and all characters after them on a line are treated as comments and ignored.

The above example could be accomplished with the #1 example azimuth-list in the file supplied on the KANSAS CITY TRACKER release diskette named BBSROTOR.DAT.

The azimuth-list file will be sorted into order by segment start time. Keep the list in order to make changing it easier. The table will make more sense to you if you have an initial table entry that defines the rotor position to be assumed the instant the cycle-period starts. Where records with duplicate starting times exist, the first record is accepted and later records with the same start time are ignored. The azimuth-list entries each occupy one entry in the driver's Time/Target table. BBSROTOR will abort if there are insufficient table entries defined in the driver table for the azimuth-list entries. If this error should occur, increase the number of Time/Target entries defined in the driver, reboot your system, reload the driver, and rerun BBSROTOR. Once you have used BBSROTOR to load your table you may notice (on the Tracker status pop-up) the driver "walking" through the table entries at a rate of about one entry a second. The driver does this to align itself with the correct current table entry. Once the driver locates the correct current the display will stabilize and the rotors will track as they should.

12.0 THE APPLICATION PROGRAM DEPH.COM

This program has been developed to provide a way to unload the driver's Time/Target table from memory to disk. The file created can be loaded back into the driver's table using the LEPH.EXE program described below. This program is particularly useful if you have loaded the Time/Target table and then find you need to reboot your machine for some reason. You would use DEPH.COM to dump the table to disk, reboot your machine, and then use LEPH.EXE to reload the Time/Target table from disk. The default output file name is SAT.LST. The output file name and extension can be overridden by supplying the file name (extension defaults to .LST) or filename and extension on the command line. This program will only dump the driver's table if the current table processing mode is "NORMAL". When the dump is completed the Time/Target table is marked as empty.

Examples:

```
  C>DEPH              <--- Use the default file name of SAT.LST
  C>DEPH DATA         <----Use supplied name & default extension (.LST)
  C>DEPH DATA.TXT     <--- Use the supplied name & extension
```

13.0 THE APPLICATION PROGRAM LEPH.EXE

This program has been developed to provide a way to load the tracking-data file created by DEPH.COM or Silicon Solutions' SEPH program into the driver's Time/Target table. The default input file name is SAT.LST. The input file name and extension can be overridden by supplying the file name and extension on the command line. This program will return the driver's table mode to normal-mode as reqd.

NOTE: When SEPH is used to create the tracking-data file it should be run using option #3 (1 observer to 1 satellite).

Examples

```
  C>LEPH              <--- Use the default file name of SAT.LST
  C>LEPH DATA.TXT     <--- Use the supplied name & extension
```

14.0 THE APPLICATION PROGRAM SCANCODE.COM

This program has been developed to provide a way of easily determining the keyboard scan code of any particular key. The program will prompt you for a keystroke, and then display the scan code of the key you have pressed. Press <ALT> and then <ENTER> to terminate the program.

15.0 THE APPLICATION PROGRAM TEST.EXE

This program allows the user to directly control the interface card's Tracker control outputs (Left, Right, Up, Down, and Brake if applicable), Tuner control outputs (Port C Up and Down and Port D Up and Down). It can display the position-sensing results for the azimuth and elevation analog inputs. It can send mode commands to Yaesu, Icom, and Kenwood radios. The prompts are straight-forward; type TEST at the DOS prompt and follow the instructions. The TEST.EXE program must not be run when the driver DRV.COM is resident in memory, as the two programs will fight each other in trying to control the Tracker/Tuner interface hardware. If your board is not at the standard I/O address ($3E0) you should put the correct I/O address on the command line. For example, if your board is at I/O address $1E0, at the DOS prompt you would type "TEST $1E0" (without the quotes).

16.0 THE APPLICATION PROGRAM TTTEST.EXE

This program was heavily used in the original KC Tracker and KC Tuner development. It loads into the Tracker's Time/Target table a simulation of an OSCAR-10 pass. The pass consists of 90 position records and moves from AOS to LOS in 30 minutes. The beacon frequency information centers on 145.0 mhz. This program can be VERY handy in setting up and testing both the KC Tracker and KC Tuner.

TTTEST arranges the table records so the pass starts (by default) 3 seconds after TTTEST runs. TTTEST accepts up to three fully optional numeric command-line operands. The right-most number (if any) is increased by 3 and added to the KC Tracker's current second to compute the pass's start time. The second number from the right (if any) is added to the KC Tracker's current minute to compute the pass's start time. The third number from the right (if any) is added to the KC Tracker's current hour to compute the pass's start time.

Command-Line Examples

```
  C> TTTTEST                     <--- Starts the pass in 3 seconds
  C> TTTTEST  10                 <--- Starts the pass in 13 seconds
  C> TTTTEST   5  10             <--- Starts the pass in 5 minutes, 13
                                      seconds
  C> TTTTEST   1  30  0          <--- Starts the pass in 1 hour, 30
                                      minutes, 3 secs
```

17.0 THE APPLICATION PROGRAM POINT.EXE

(NOTE: THIS PROGRAM WAS NAMED "CALL" IN RELEASES PRIOR TO 2.32)

This program has been developed to let the user aim the antenna array at a remote station by specifying the remote station identifier. The user creates an ascii text file consisting of station identifiers and azimuths.

The user then runs POINT and responds to the prompt with the station identifier desired. POINT will look up the specified identifer and move the rotors to the correct azimuth for the specified station.

Command Format:

```
  C> POINT                          <--- POINT will prompt for station id
  C> POINT station-identifier       <--- POINT will move rotor & exit
```

The station identifier can be the remote station's callsign, the operator's name, or whatever. The identifier must not contain imbedded spaces or TAB characters. This program is not case-sensitive.

The station-identifier file must be named POINT.DAT and must be in the default directory. It must be an ASCII text file. This file can be created using the DOS text edit program called EDLIN.COM. Each line of the file must be blank or have the station-identifier followed by its azimuth in degrees. The station-identifier and azimuth must be separated by spaces or tabs. Legal azimuth values go from 0 to 359, inclusive. The following example shows the format of the station-identifier file:

```
KC2TN     123
WB2MNF    242
Dave       12
Joe        43
KB2CST      0
N4HY      317
KC2PH     211
Henry     191
KA2MOV      5
```

POINT.EXE uses the DOS "SHELL" function to access the "MOVENOW.COM" program described in a prior section. MOVENOW.COM and the DOS command processor COMMAND.COM must be accessible in the default directory or via the current PATH command.

18.0 USING AMSAT/N4HY'S QUIKTRAK PROGRAM (VERSION 3.2)

The following examples are intended to provide a quick reference on how to use AMSAT/N4HY's QUIKTRAK program version 3.2. A newer version (4.0) is now available. The examples here can be applied to version 4.0 with minor changes due to the different menu selection format of version 4.0.

The KANSAS CITY TRACKER software was designed to run with N4HY's program. You should have version 3.2 (or newer) of QUIKTRAK, and should read the manual provided with QUIKTRAK. Note that there are two versions of the QUIKTRAK program, one for PC's with math co-processors (8087 or 80287) installed (QUIK87) and one for PC's without math co-processors (QUIKFPA) (This is not true of version 4.0).

OPERATIONAL NOTE: When you change the QTH data using QUIKTRAK's QTH edit function, set the "ROTOR ?" option to: YI99. The Y and I must be capital letters.

QUIKTRAK 3.2 "unpacks" into a series of files that occupies about 500k bytes of disk space. This can cause problems if you have no hard disk. In this situation, type the following commands to unpack to your B: drive just the actual files needed to run QUIKTRAK:

```
PKXARC DISTRIB B: QUIKFPA.EXE
PKXARC DISTRIB B: HYMAP.MAP
PKXARC DISTRIB B: HYZOOM.MAP
PKXARC DISTRIB B: QTHC.DAT
PKXARC DISTRIB B: QTHED.HLP
PKXARC DISTRIB B: KEPC.DAT
PKXARC DISTRIB B: KEPED.HLP
PKXARC DISTRIB B: CITY.DAT
```

These files will occupy about 238k bytes of disk space.

NOTE: This example assumes that the driver (DRV.COM) is already loaded into memory.

```
***********************************************************************
*  A quick demonstration of satellite tracking using the driver's    *
*  Time/Target table to pre-table the satellite pass.                 *
***********************************************************************
```

Starting from the DOS prompt...

```
C> CD\QUIKTRAK

C> QUIK87          <--- If you have a math co-processor
or
C> QUIKFPA         <--- If you don't have a math co-processor
```

Then select...

```
B       - for "Tracking"
D       - for the satellite FO-12
<ENTER> - to keep local (PC) time
1T      - for 1 min. time step; also to pass table entries to
the driver (numeric time followed by alpha "T").
Y       - to clear the current Time/Target table entries
```

When the pass calculations complete...

```
0   - to return to the main menu
Q   - Quit to exit to DOS
```

If you now bring up the status pop-up window using the selected hot-key, you'll see the satellite pass data in the Time/Target table display. When the pass starts the rotor will track the satellite.

NOTE: This example assumes that the driver (DRV.COM) is already loaded into memory.

```
*************************************************************************
*    A quick demonstration of satellite tracking using the driver      *
*    to track the satellite in real time.                               *
*************************************************************************
```

NOTE: The status pop-up can not be invoked when the QUIKTRAK program is displaying the world map, as this is done in graphics mode and the pop-up will not function in graphics mode. No damage is done if the pop-up is accidently invoked while in graphics mode - the pop-up will ignore the invokation.

Starting from the DOS prompt...

```
C> CD\QUIKTRAK
C> QUIK87      <--- If you have a math co-processor or
C> QUIKFPA     <--- If you don't have a math co-processor
```

Then select...

```
G       - to select realtime, 1 satellite
G       - to select a graphical display
D       - to select the FO-12 satellite
<ENTER> - to keep local (PC) time
```

Use...

```
lower-case 'f' - speeds up the time steps (faster than realtime).
                 Can be pressed several times to really speed things up.
lower-case 's' - slows the time steps; can be pressed several times.
```

As the satellite elevation approaches zero, hit lower-case 's' several times to return to realtime calculations, and hit lower-case 'a' to pass the position information to the driver. The rotor will track the satellite.

Use zero ("0") to exit to QUIKTRAK's command prompt.

19.0 USING GRAFTRAK

The following examples are intended to provide a quick reference on how to use the KANSAS CITY TRACKER with GRAFTRAK. The KANSAS CITY TRACKER software was designed to run with GRAFTRAK version 2.0. You should read the manual provided with GRAFTRAK before attempting to use it.

These examples assume that the driver (DRV.COM) and status pop-up (OSC.COM) are already loaded into memory. The driver must be told when loaded that it is be used with GRAFTRAK. This is done with the /GT=1 command-line option when DRV.COM is loaded. Note that the interrupts selected by Silicon Solutions for their TSR interface (67h & 68h) are in common use as the application-interrupt interface to the Lotus -Intel -Microsoft (LIM) Expanded -Memory -Specification (EMS and EEMS). If you have an extended memory driver installed in you CONFIG.SYS file, it must be removed when you want to use the GT program to control your rotors in real time. This is not a problem with the SEPH program, which lets you table the satellite passes ahead of time. In general this is not a major problem as most users table the satellite pass ahead of time using SEPH.

```
***********************************************************************
*  A quick demonstration of satellite tracking using the driver's    *
*  Time/Target table to pre-table the satellite pass.                *
***********************************************************************
```

Starting from the DOS prompt...

```
C> CD\GT
```

```
C> SEPH command-line-options
```

Select Single satellite, single observer mode. Select the satellite you wish to track. When the pass calculations complete SEPH will have written a data file called SAT.LST. AT the DOS prompt type...

```
C> \KCT\LEPH x
```

where x is the name of the file SEPH created. The default file name is SAT.LST.

If you now pop up the status pop-up using the selected hot-key, you'll see the satellite pass data in the Time/Target table display. When the pass starts the rotor will track the satellite.

```
**********************************************************************
*    A quick demonstration of satellite tracking using the driver    *
*    to track the satellite in real time.                            *
**********************************************************************
```

Starting from the DOS prompt...

```
C> CD\GT

C> GT command-line-options (Do NOT use the "AC" option!)
```

Select Single satellite, single observer mode. Select the satellite you wish to track. When the satellite comes over the horizon the rotor will track the satellite.

20.0 USING YOUR OWN INTERFACE PROGRAM

The software interface to be used between the driver (DRV.COM) and an application program or TSR is described in the release-disk file named DRVSVC.DOC. Programmers wishing to interface to the driver should use this interface. It will not vary much from release to release. If you would like to have a new service added to the driver that you believe would be advantageous to you and your fellow hams, please contact us.

If the elevation value supplied through the driver's service-interrupt entry point has a value of greater than 90, 180 is subtracted from both the elevation and azimuth values. This is done to keep the range of elevation values the driver has to deal with in the range of -90 to +90. Application programs that supply target information to the driver should try to do this pre-processing themselves as it will be confusing to see that an application program sent EL/AZ values of 180/20 but the driver accepted values of 0/200. NOTE: The OSC.COM pop-up avoids this problem by only accepting elevation values in the range of -90 to +90.

Appendix A: I/O Port Address Table

This is the table of I/O addresses and corresponding dipswitch settings to be used with the interface card. The number to the left of the "=" sign is the I/O address. The 1's and 0's to the right of the "=" sign are the corresponding settings for each of the eight dipswitches. The leftmost 0/1 is for switch #1 (labeled on the dipswitch pack). Moving to the right in the string of 1's and 0's, each 1/0 corresponds to the next switch, with the right-most 1/0 representing switch #8. If the table value for a switch is 0, the switch should be set OFF or OPEN. If the table value for a switch is 1, the switch should be set ON or CLOSED. The OFF/OPEN and ON/CLOSED settings are marked on the dipswitch. See "Installing the Interface Card" for the suggested switch setting.

I/O Switch	I/O Switch	I/O Switch	I/O Switch
ADDR 12345678	ADDR 12345678	ADDR 12345678	ADDR 12345678
*************	*************	*************	*************
0000=11111111	0004=11111011	0008=11111101	000C=11111001
0010=11111110	0014=11111010	0018=11111100	001C=11111000
0020=11110111	0024=11110011	0028=11110101	002C=11110001
0030=11110110	0034=11110010	0038=11110100	003C=11110000
0040=10111111	0044=10111011	0048=10111101	004C=10111001
0050=10111110	0054=10111010	0058=10111100	005C=10111000
0060=10110111	0064=10110011	0068=10110101	006C=10110001
0070=10110110	0074=10110010	0078=10110100	007C=10110000
0080=11011111	0084=11011011	0088=11011101	008C=11011001
0090=11011110	0094=11011010	0098=11011100	009C=11011000
00A0=11010111	00A4=11010011	00A8=11010101	00AC=11010001
00B0=11010110	00B4=11010010	00B8=11010100	00BC=11010000
00C0=10011111	00C4=10011011	00C8=10011101	00CC=10011001
00D0=10011110	00D4=10011010	00D8=10011100	00DC=10011000
00E0=10010111	00E4=10010011	00E8=10010101	00EC=10010001
00F0=10010110	00F4=10010010	00F8=10010100	00FC=10010000
0100=11101111	0104=11101011	0108=11101101	010C=11101001
0110=11101110	0114=11101010	0118=11101100	011C=11101000
0120=11100111	0124=11100011	0128=11100101	012C=11100001
0130=11100110	0134=11100010	0138=11100100	013C=11100000
0140=10101111	0144=10101011	0148=10101101	014C=10101001
0150=10101110	0154=10101010	0158=10101100	015C=10101000
0160=10100111	0164=10100011	0168=10100101	016C=10100001
0170=10100110	0174=10100010	0178=10100100	017C=10100000
0180=11001111	0184=11001011	0188=11001101	018C=11001001
0190=11001110	0194=11001010	0198=11001100	019C=11001000
01A0=11000111	01A4=11000011	01A8=11000101	01AC=11000001
01B0=11000110	01B4=11000010	01B8=11000100	01BC=11000000
01C0=10001111	01C4=10001011	01C8=10001101	01CC=10001001
01D0=10001110	01D4=10001010	01D8=10001100	01DC=10001000
01E0=10000111	01E4=10000011	01E8=10000101	01EC=10000001

Table continues on next page...

```
01F0=10000110     01F4=10000010     01F8=10000100     01FC=10000000
0200=01111111     0204=01111011     0208=01111101     020C=01111001
0210=01111110     0214=01111010     0218=01111100     021C=01111000
0220=01110111     0224=01110011     0228=01110101     022C=01110001
0230=01110110     0234=01110010     0238=01110100     023C=01110000
0240=00111111     0244=00111011     0248=00111101     024C=00111001
0250=00111110     0254=00111010     0258=00111100     025C=00111000
0260=00110111     0264=00110011     0268=00110101     026C=00110001
0270=00110110     0274=00110010     0278=00110100     027C=00110000
0280=01011111     0284=01011011     0288=01011101     028C=01011001
0290=01011110     0294=01011010     0298=01011100     029C=01011000
02A0=01010111     02A4=01010011     02A8=01010101     02AC=01010001
02B0=01010110     02B4=01010010     02B8=01010100     02BC=01010000
02C0=00011111     02C4=00011011     02C8=00011101     02CC=00011001
02D0=00011110     02D4=00011010     02D8=00011100     02DC=00011000
02E0=00010111     02E4=00010011     02E8=00010101     02EC=00010001
02F0=00010110     02F4=00010010     02F8=00010100     02FC=00010000
0300=01101111     0304=01101011     0308=01101101     030C=01101001
0310=01101110     0314=01101010     0318=01101100     031C=01101000
0320=01100111     0324=01100011     0328=01100101     032C=01100001
0330=01100110     0334=01100010     0338=01100100     033C=01100000
0340=00101111     0344=00101011     0348=00101101     034C=00101001
0350=00101110     0354=00101010     0358=00101100     035C=00101000
0360=00100111     0364=00100011     0368=00100101     036C=00100001
0370=00100110     0374=00100010     0378=00100100     037C=00100000
0380=01001111     0384=01001011     0388=01001101     038C=01001001
0390=01001110     0394=01001010     0398=01001100     039C=01001000
03A0=01000111     03A4=01000011     03A8=01000101     03AC=01000001
03B0=01000110     03B4=01000010     03B8=01000100     03BC=01000000
03C0=00001111     03C4=00001011     03C8=00001101     03CC=00001001
03D0=00001110     03D4=00001010     03D8=00001100     03DC=00001000
03E0=00000111     03E4=00000011     03E8=00000101     03EC=00000001
03F0=00000110     03F4=00000010     03F8=00000100     03FC=00000000
```

Appendix B: Interface Connector Pinouts

The 25-pin connector on the interface cards has the following pin assignments. The other pins are sometimes used for internal functions and should not be used for tie points. The pin numbering follows the standard DB25 numbering system, and are labeled on the supplied connector. This section describes the pins used for the KC Tracker. Other pins used for the KC Tuner are described in the KC Tuner manual

NOTE: The regulated power pins (14, 19, & 21) are brought out for testing purposes. These supply pins should not be used unless you are VERY sure of your intended use and its load requirements.

The LLG01 Rotor Interface

PIN	DESCRIPTION	
1	Ground	
3	Up control output	- Open-Collector TTL output
5	Down control output	- Open-Collector TTL output
7	Right control output	- Open-Collector TTL output
9	Left control output	- Open-Collector TTL output
11	Vertical analog input	- 0 to +5vdc
13	Horizontal analog input	- 0 to +5vdc
19	Regulated +5 vdc from the PC's power supply	
21	Regulated +12vdc from the PC's power supply	

The LLG02 Rotor Interface

PIN	DESCRIPTION
1	Ground
3	Up control output (1)
5	Down control output (1)
6	Rev B boards: Not Connected; Rev C boards: Ground
7	Right control output (1)
8	Azimuth brake release (2)
9	Left control output (1)
10	Port-A Serial Input
11	Vertical analog input
12	Port-B Serial Input
13	Horizontal analog input
14	Regulated -12vdc from the PC's power supply
15	Rev B boards: Not Connected; Rev C boards: Ground
16	Rev B boards: Not Connected; Rev C boards: Ground
17	Rev B boards: Not Connected; Rev C boards: Ground
18	Port-A Serial Output
19	Regulated +5vdc from the A-to-D converter's regulator
20	Port-B Serial Output
21	Regulated +12vdc from the PC's power supply
22	Port-C Click-Down
23	Port-C Click-Up
24	Port-D Click-Down
25	Port-D Click-Up

NOTE #1: Open-collector TTL outputs, 30ma max, 30vdc open-circuit max. The current-sinking ability is expanded to 300ma if the Rotor Interface Option is installed.

NOTE #2: Rotor Interface option only. The brake release output is energized 1 second before elevation or azimuth movement and is held energized until 3 seconds after all movement ceases. This output can be used to control an azimuth-rotor brake release, or to control power to your rotor controller(s).

Appendix C: Using the "ROTOR INTERFACE OPTION"

The rotor interface option is available for those users who don't have a Yaesu/Kenpro 5400A/5600 -A/B rotor controller. The option replaces the normal TTL control outputs with high-current (300ma max) open-collector relay-driver outputs. In use, each control output drives a relay that in turn closes the appropriate switch on your rotor controller. Position sensing voltages are derived from the position pots in the rotor itself. The KC Tracker must be supplied DC position voltages.

If you are not sure of your rotor, send us the schematics and we'll review your installation. When the installation is completed the rotor can be controlled using the manual controls as before or by your computer. The only parts you need to buy are 4 or 5 12vdc relays and 2 multi-turn 10k pots. Radio Shack sells relays (part # 275-218B) and multi-turn pots (271-343) that are adequate for this application.

The typical application for this product is in driving a Kenpro KR-400 & KR-500 azimuth and elevation rotor setup. The following installation descriptions are oriented toward this application.

A program called TEST.EXE has been added to the software release diskette. This program gives the operator control over the individual movement- control outputs of the interface card. It can also report the position sensing results. Users installing the KC Tracker with the Rotor Interface Option in a custom setup will find these functions useful.

Obtaining a DC position sensing voltage: The KC Tracker needs a analog DC voltage to determine the current rotor position. If your rotor control box applies an AC voltage across the position pot, use a diode (1N4001 or equivalent), a 100uf capacitor, and a 10k bleeder resistor to create a DC voltage. The DC voltage should cover the range of 0 to +5 volts. The voltage should never drop below 0 volts, and should not exceed +5 volts. In making the connections described here, remember that these connections are made to terminals without disturbing the existing wiring. The connections are "piggy-backed" onto the existing wiring. Look at the schematic for your rotor controller and determine which terminals are connected to the rotor pot's center wiper and GROUND resistor-element end. Connect the rotor pot's GROUND to one of the KC Tracker's ground terminals and to one end of the resistive element of the multi-turn pot. Connect the rotor pot's wiper lead to the other end of the multi-turn pot's resistive element. Connect the wiper of the multi-turn pot to the appropriate analog input of the KC tracker (see the appendix INTERFACE CONNECTOR PINOUTS). Turn the rotor controller ON and move the rotor until the maximum voltage is applied to the multi-turn pot (measure the pot end-to-end with a VOM). Leaving the rotor in this position, measure the voltage between the ground and analog position input for this rotor on the 'Tracker card. Adjust the multi-turn pot until this voltage is about 3 volts (not critical).

When both rotors (assuming an AZ-EL rotor setup) have been properly connected to the 'Tracker, run the INSTALL program on the 'Tracker release disk per the instructions. You have pre-set the position voltages, so those instructions can be ignored. Do adjust the multi-turn pots so as to return a position value as close to 254 as possible when requested to do so.

Note: Some of the TV-style rotors ground the pot's wiper to the case of the rotor, and therefore to electrical ground. On units of this type, the wiper of the pot should be connected to the ground lines of the KC Tracker board. The analog input to the tracker should be picked up from the POSITIVE end of the rotor pot. If the voltage applied across the pot is an AC voltage, either end can be selected, rectified with a diode and capacitor (as mentioned above), and passed to the KC Tracker's analog input.

Using the control outputs to control your rotors: Each of the control outputs from the 'Tracker card should be connected to one end of each of the 4 (5 if either rotor has a separate brake- release switch) relays coils. The other end of each of the relay coils should be tied together into a common bus and returned to pin 21 of the 'tracker card. Your PC will power the relays without any problems. The KC Tracker card has on-board EMP-suppression diodes and capacitors. The normally-open contacts of each relay should be connected across the appropriate switch (the UP control output controls the relay across the UP switch, etc.) We recommend that these relays be placed in the rotor controller housing if possible. In most amateur-radio rotors with brake-release switches on the rotor controller, the brake-release switch is connected across the AC power line. BE VERY CAREFUL TO INSTALL THE RELAYS IN THIS ENVIRONMENT SO AS TO ENTIRELY ELIMINATE ALL POSSIBILITY OF SHORTS OR SHOCKS. If you have ANY questions, feel free to call before continuing.

L.L. Grace

Technical Products and Services

READ ME!

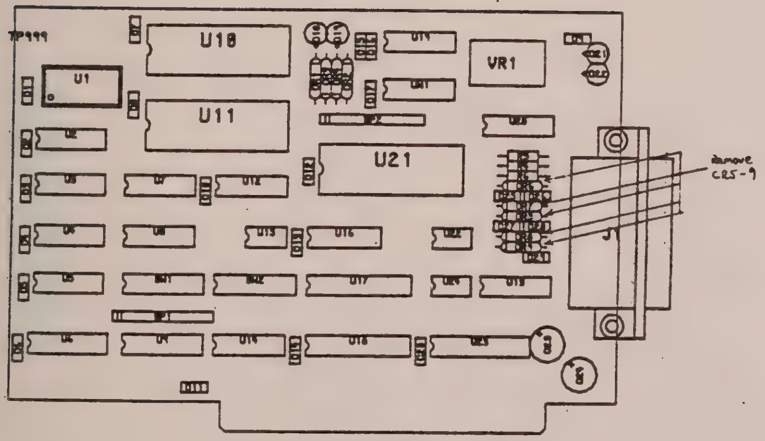
Effective January 15, 1992, L.L. Grace has combined the Kansas City Tracker, the 5400/5600 rotor-family interface cable, and the Rotor Interface Option into a single package. We have made this change to ensure our customers always receive the products and options they need.

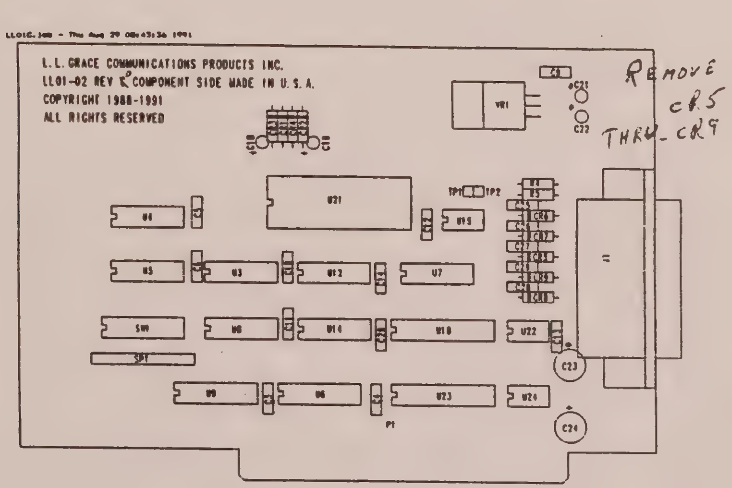
The Rotor Interface Option hardware is designed to provide enough drive capability to handle relay coils. This circuitry, which is included on the KC Tracker board, includes 5 diodes whose purpose is to protect the output drivers from inductive "spikes" coming back from the relay coils.

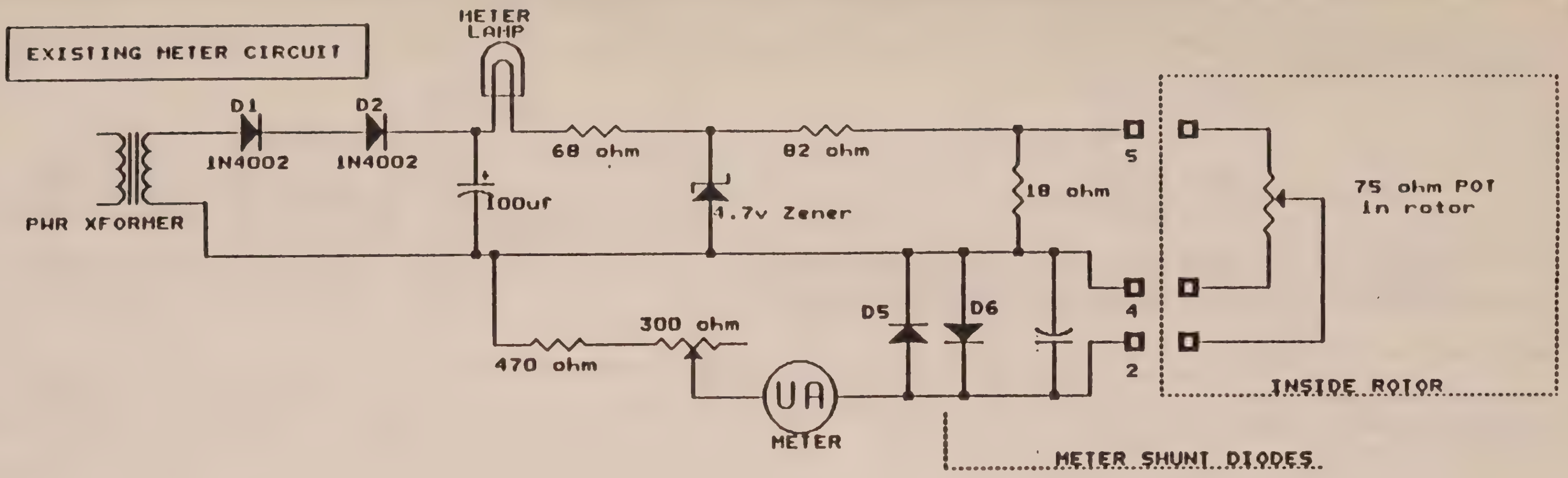
The circuitry of the Rotor Interface Option is such that when a KC Tracker board with the Rotor Interface Option is connected to a 5400/5600-family rotor controller (these are made by Kenpro and Yaesu), the rotor controller "thinks" the PC is telling it to move in azimuth and elevation always, even when the PC is turned off.

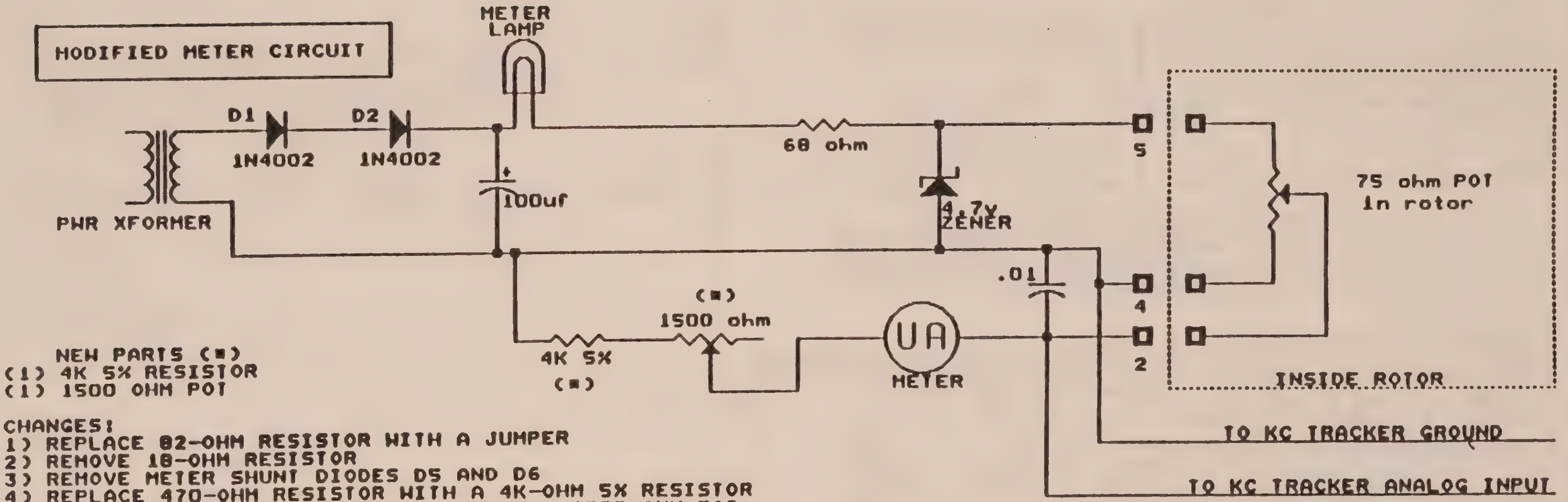
The solution to this situation is easy! When using the KC Tracker board with a 5400/5600-family rotor controller, clip one end (or remove) diodes CR5, CR6, CR7, CR8, and CR9 as indicated in the drawings below. The board should not be used to drive relays without these diodes.

Should you wish to use the KC Tracker board with both a 5400/5600 rotor and with relays on a different rotor setup, remove the diodes as described above and add diodes across the relay coils. A suitable diode is the 1N4004. Ensure the diodes are placed across the relay coils in the reverse direction of normal current flow or the KC Tracker's on-board relay drivers will be damaged.




L.L. GRACE COMMUNICATIONS PRODUCTS INC.
LL01-02 REV C COMPONENT SIDE MADE IN U.S.A.
COPYRIGHT 1988-1991
ALL RIGHTS RESERVED
VR1
U21
CR6
CR7
CR8
CR9
REMOVE CR5 THRU CR9





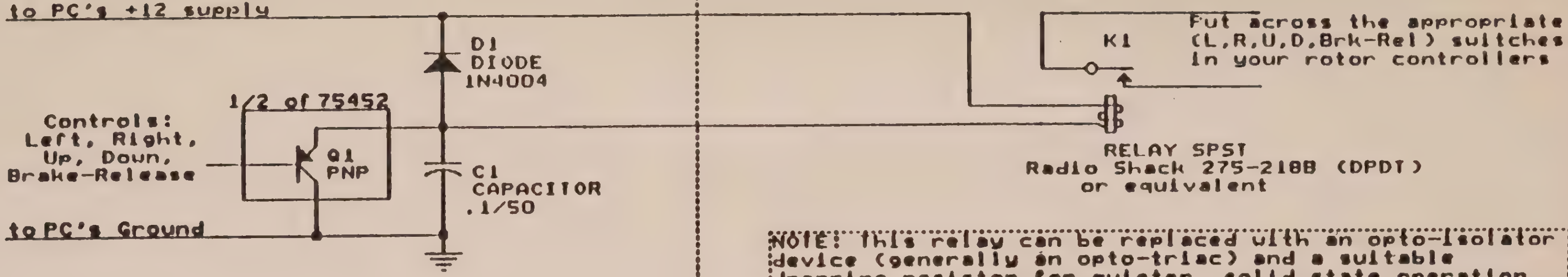
NEW PARTS (*)
(1) 4K 5% RESISTOR
(1) 1500 OHM POT

CHANGES:
1) REPLACE 82-OHM RESISTOR WITH A JUMPER
2) REMOVE 18-OHM RESISTOR
3) REMOVE METER SHUNT DIODES D5 AND D6
4) REPLACE 470-OHM RESISTOR WITH A 4K-OHM 5% RESISTOR
5) REPLACE 300-OHM METER-ADJ POT WITH A 1500-OHM POT
6) ADD KC TRACKER INTERFACE

THANKS TO BILL LEIBENHAUT KB2E
FOR HIS HELP IN THESE DESIGN CHANGES

Size	Document Number	REV
A	ALLIANCE HD-73 CHANGES	1

<---- PC Board | External Components ---->



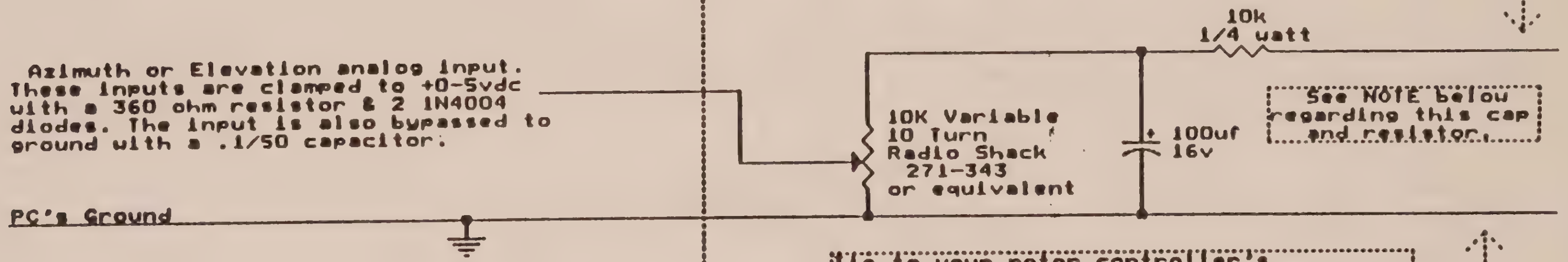
Put across the appropriate (L,R,U,D,Brk-Rel) switches in your rotor controllers

NOTE: This relay can be replaced with an opto-isolator device (generally an opto-triac) and a suitable dropping resistor for quieter, solid state operation.

This circuit occurs 5 times on the KC Tracker board.

Duplicate the relay circuit for each control & for the Brake Release. 4 or 5 relays are required.

Tie to your rotor controller's positive-going position-sense lead.



Azimuth or Elevation analog input. These inputs are clamped to +0-5vdc with a 360 ohm resistor & 2 1N4004 diodes. The input is also bypassed to ground with a .1/50 capacitor.

See NOTE below regarding this cap and resistor.

Tie to your rotor controller's Ground. This circuit assumes your rotor controller's sense voltage is positive going relative to this ground.

NOTE: The fixed resistor and capacitor shown above are only needed if your rotor "shares" a wire between the position-sensing pot and the motor. Some of the less expensive "TV" type rotors use the same wire for the pot wiper and motor common, inducing power hum into the position voltage while the motor is running. Do not install these components if your rotor has separate, isolated wires for all three legs of the position sensing pot.

Duplicate the scaling-resistor circuit for the elevation and azimuth rotor controllers. Two variable-resistors are required.

KC Tracker | User-supplied

KC Tracker Rotor Interface Option		
Size A	Document Number	REV A

KANSAS CITY TUNER

INSTRUCTIONS

VERSION 2.40 Dated: July 23, 1990

Table Of Contents

1.0 GETTING STARTED.. 1
2.0 KC TUNER FUNCTIONS..................................... 2
3.0 RADIO PORTS.. 3
4.0 MORE THAN 4 KC TUNER PORTS............................. 3
5.0 LOADING THE KC TUNER INTO MEMORY....................... 4
6.0 USING THE KC TUNER..................................... 7
7.0 TUNER WINDOWS AND KEYS................................. 8
7.1 Window Fields.................,........................ 10
Appendix A: LLG02 connector pinout and output options...... 13
Appendix B: Connecting to ICOM radios...................... 16
Appendix C: Connecting to Yaesu Radios..................... 18
Appendix D: Connecting to Kenwood TS-711/811............... 20

1.0 GETTING STARTED

Unfortunately, we could not name this section GETTING STARTED QUICKLY. The KC Tuner is a VERY complex product. In this manual it is assumed that you have copied the KC Tuner program (TUNER.COM) to the same directory as the KC Tracker files.

Some Recommendations

Read this manual entirely before attempting to use the Tuner functions.

Get the KC Tracker up and running to your satisfaction before starting to work with the KC Tuner. The KC Tracker driver (DRV.COM) provides functions needed by the Tuner and must be resident in memory before the Tuner is loaded, so you might as well start with the KC Tracker.

Set your PC's time to WWV or an equivalent standard. We have found in our field testing that it is CRITICAL that your PC's time of day be set exactly right. Variances of just 20 seconds can cause the frequency to be off by as much as 800hz. An inaccurate time creates a non-linear time offset that the KC Tuner can't correct.

Tune the uplink as well as the downlink. Our test sites were amazed at the difference this made in working the satellites reliably. Users have worked FO-20 (JD mode) easily on passes that peaked at 6 degrees of elevation!

KEEP YOUR KEPLERIAN INFORMATION AND PC TIME RIGHT ON THE MONEY. IT IS AMAZING HOW CRITICAL THESE TWO FACTORS ARE IN MAINTAINING CORRECT TUNING!

2.0 KC TUNER FUNCTIONS

The KC Tuner is designed for satellite radio work. During a satellite pass, the satellite approaches and then recedes from your position. This movement relative to your position creates a doppler shift in the signal you receive from the satellite and in the signal the satellite receives from you. The KC Tuner's function is to tune your uplink and downlink radios during a satellite pass so as to compensate for this doppler shift. This doppler shift can be more than 5khz.

The Tuner function is best suited for digital work on the satellite itself. For analog transponder work, both ends of the link need to be running the KC Tuner for the QSO to be effectively and automatically tuned by the Tuner.

There are two advantages in using the Tuner. The first relates to your ease of operation; during the satellite pass you can work the satellite without needing to constantly turn around and retune your radio. The second advantage relates to the satellite's passband. If you are using the Tuner to tune the uplink frequency, the satellite always sees the uplink signal in the middle of its passband. You will achieve solid, reliable communications, especially on FM uplinks where the "capture effect" works to your advantage. In the case of the MicroSats with their multiple baud rates (1200/4800), uplink tuning is a requirement for the higher-speed data channels. The KC Tuner can fully automate this function for you.

The KC tuner can control the frequency of your uplink and downlink radios through either one of two possible methods. The first method is the one we will call "mic-click". The mic-click interface is available for those radios that have UP and DOWN step buttons on the microphone. All versions of the KC Tuner have open- collector TTL outputs that can be used to actuate these switches. As an example, the Yaesu 726 has UP & DOWN switches on the mic and a control on the radio itself that sets the step frequency change to 100hz or 200hz. The KC Tuner mic-click outputs can electrically operate these switches to make the radio "step" up or down in frequency as required. The second interface available is the serial interface. This interface can be used to control radios that have a serial radio-control port, eg. Kenwood 711/811 & 790, Icom 275/475/R7000, Yaesu 736. The serial interface is much easier to use than the mic-click interface, and should be used if your radios (uplink and/or downlink) have a serial interface.

3.0 RADIO PORTS

Starting with version 2.20, the KC Tuner software supports eight "ports," each of which can be used to control a radio. Ports A, B, E, and F are serial ports. The serial ports can be operated at TTL (0=0v, 1=+5v) or RS-232 (0=+12v, 1=-12v) levels, depending on the level-converter/header-plug options described in the LLG02 CONNECTOR PINOUT AND OUTPUT OPTIONS appendix. Ports C, D, G and H are mic-click ports.

Throughout this manual you will find references to your radios' STEP value. We define STEP to be the minimum frequency change a particular radio is capable of making. For mic-click ports this is the frequency change caused by a single mic-click.

Information on connecting the serial or mic-click ports to your radio is provided in the appendices.

You will find the program TEST.EXE to be of great help when installing the KC Tuner and KC Tracker. The program is included on the release diskette. Just type TEST at the DOS prompt - the program is fairly self-explanatory.

4.0 MORE THAN 4 KC TUNER PORTS

Ports A to D are available on the normal KC Tracker/Tuner board. At your option you can purchase a second Tracker/Tuner board and configure it as a second KC Tuner board, providing an additional four radio ports. These new radio ports will be addressed by the software as ports E to H. The first two ports on any board are always serial, the second two ports are always mic-click type ports. The second board is installed by setting the additional board's I/O address on its dipswitches to four (4) more than the original board's I/O address. For example, the default I/O address for a board is 3E0 (hex); an additional board's I/O address would be set to 3E4. A table of switch settings and I/O addresses is provided in the KC Tracker manual.

5.0 LOADING THE KC TUNER INTO MEMORY

The KC Tuner program is a Terminate-and-Stay-Resident (TSR) program. These programs attach themselves to DOS and disappear, letting you run almost any program you wish while your PC tunes the radios in its spare time. The KC Tuner program is called TUNER.COM and is included on the release disk (version 2.04 and up).

The KC Tuner is loaded into memory by typing TUNER at the DOS command prompt. We recommend the use of a batch file to load the KC Tracker and Tuner. You can insert these commands into your AUTOEXEC.BAT file to be automatically loaded whenever you boot your PC, or you can create a separate batch file for loading these TSRs.

There are a series of command-line options available to the KC Tuner, some of which must be specified when loading the KC Tuner into memory. Command-line options are specified on the same line as the TUNER command. Each option consists of a leading slash ("/"), the parameter identifier, an equal sign ("="), and the option setting. The command-line options are described in the next paragraphs, and an example command-line is included at the end of this section. NOTE: Command-line option settings that require a number can be entered in decimal (the default mode). They can also be entered in hexidecimal if a leading dollar sign ($) is provided (eg, $18).

Command-Line Options

In this text, the lower-case "n" after each option identifier indicates that the option value descried in the accompanying text should be placed at this point. Many of these options apply to specific ports; in this case, the last character of the option identifier indicates the target port.

HOT This option specifies the hot-key that is to be used to invoke the TUNER status pop-up. This option MUST be specified. The SCANCODE.COM program on the release diskette can be used to determine the scancode of the key you wish to use as the hot key. We recommend either F12 (shift=0,hot=$58) if your keyboard has it, or ALT-P (shift=5, hot=$19) if not.

SHIFT This option specifies the shift-state of the TUNER status pop-up hot key. A value of 0 means No Shift Keys pressed
1 " Right shift key pressed
2 " Left shift key pressed
3 " Either shift key pressed
4 " any CTRL key pressed
5 " any ALT key (default)
6 " any CTRL and any ALT key

FILE	The KC Tuner creates and maintains a file of satellite parameters as the user uses the windows to change the satellite data base. This file contains mostly hex characters and can not be modified by using a text edit program. The user should specify the drive, path, and filename where this information should be stored. We normally use TUNER.DAT as the file name. You MUST specify the drive and path information
TSRIO	The tuner normally writes the changes to the satellite data base to disk during the next user-initiated DOS call. If you want to suppress the writing of these changes to disk, set this option to 0 (eg, /TSRIO=0).
STA STB STC STD STE STF STG STH	This option specifies the radio's frequency step size in hz. The step size of the radio is normally its minimum frequency change. For radios using the mic-click interface this parameter specifies how much the frequency changes when the mic is "clicked". This parameter is used for serial-interface radios to specify the acceptable tuning tolerance. For example, the default value of 100hz will cause the Tuner to ignore frequency changes within a 100hz range centered on the current frequency (in other words, +/- 50hz). This parameter can be set from 1 to 10000hz.
TA TB TE TF	This option is used to set the radio type for serial ports. Valid radio types for this version are: KENWOOD, TS-711, TS-811, TS-790, ICOM, IC-275, IC-475, R-7000, YAESU, and 736. The default radio type for both ports A and B is ICOM. Note: The KENWOOD option assumes TS-711/811 format. The Kenwood TS-790 uses a unique interface format - if you have a TS-790 you MUST specify TS-790 specifically!
LOA LOB LOC LOD LOE LOF LOG LOH	This option is used to tell the KC Tuner that the radio on this port is driving a transverter. The parameter n specifies the transverter's local-oscillator frequency. Specify the frequency with a leading minus-sign ("-") to indicate the transverter output is less than its local-oscillator frequency. Specify the frequency with a leading plus-sign ("+") to indicate the transverter output is greater than its local-oscillator frequency. The frequency must be expressed in mhz, using a decimal point as reqd. The frequency may be expressed to the nearest 1 khz; only three digits are allowed to the right of the decimal point.
SHC SHD SHG SHH	This option is used for mic-click ports to specify whether the radio's click input is active-low or active high. The Yaesu 726's mic-click inputs are active-high. Kenwood and ICOM radio mic-click inputs are active-low. Set this parameter to 0 for active-low, and to 1 for active-high. The default is 0 (active low).

CPC CPD CPG CPH	This option is used for mic-click to specify the duration of each mic-click pulse. The duration is in milliseconds and must be at least 55 ms. The number supplied is divided by 55 before being stored by the Tuner, so the number supplied should be a multiple of 55. The default value is 165ms.
CSC CSD CSG CSH	This option is used for mic-click to specify how many times the mic inputs must be strobed before the radio "steps" in frequency. The default value is 1. Yaesu 726 radios need 5 clicks per step when the radio's step switch is set to 100hz steps.
MAV	This parameter is used to preset the antenna-output control bits. These bits are available to control antennas, radios, and so on. This default value is overridden during satellite passes and restored between satellite passes. This parameter can range in value from 0 to 3.

For example, this command line...

```
C>TUNER /hot=$19/file=c:\kct\tuner.dat/tb=yaesu
```

Will load the Tuner program into memory with a pop-up hot key of ALT-P, define the parameter database filename as C:\KCT\TUNER.DAT, and indicate that the radio on port B is a Yaesu radio. All other parameters use their default settings.

6.0 USING THE KC TUNER

This section presents a fairly simple example of how to use the KC Tuner. The user should keep in mind that the KC Tuner only works in tabled-pass mode. To run the KC Tuner you must...

1) Load the TSRs into memory (DRV.COM and TUNER.COM)
2) Bring up the Tuner's status pop-up and add to the satellite parameter database those satellites you wish to have automatically tuned for you.
3) Using QUIKTRAK or GRAFTRAK, calculate the satellite pass information and load this information into the tracker's table.

When the satellite pass begins, the KC Tuner will tune the radios for you.

1) LOADING THE TSRs: Loading the KC Tracker TSR programs (DRV and OSC) is described in detail in the KC Tracker manual. Loading the TUNER.COM TSR is described in this manual in the section entitled "Loading the KC Tuner into memory".

2) ADDING THE SATELLITE PARAMETERS: Bring up the KC Tuner using the selected hot-key. Use F3 to change to the ADD window. Add the required satellite information. A complete description of these fields can be found in the section of this manual entitled "Tuner Windows". NOTE: The satellite names must match exactly, as this name is how the KC Tuner cross- references the tracking and tuning information.

3) CALCULATE THE SATELLITE-PASS INFORMATION: Using GRAFTRAK or QUIKTRAK, load the positioning and tuning information into DRV.COM's table. An example of this is given in the KC Tracker manual. The information needed for the KC Tuner is loaded at the same time as the Tracking information - no additional steps are needed. We recommend a short time-interval between position calculations (this is an option in most satellite tracking programs). For OSCAR-12 we recommend .1 minutes (6 seconds).

4) TUNING AT THE BEGINNING OF THE PASS: The KC Tuner will automatically pick up at AOS and start tuning your radios. Any radios connected using the mic-click interfaces must be pretuned to match the KC Tuner's status pop-up display. After this pre-tuning the KC Tuner will tune the radio up or down as required for successive passes. Change the ADJUST values to "dial-in" the receiver.

7.0 TUNER WINDOWS AND KEYS

This section of the KC Tuner manual describes the Tuner status pop-up windows and the fields displayed on each window. Also described are the key functions available from the KC Tuner windows.

When the KC Tuner status pop-up is invoked using the hot-key, it appears showing the ACTIVE window. This window displays the currently active satellite (if any), its associated frequencies, etc. While a pass is active the ADJUST values can be changed by pressing TAB until the desired ADJUST field is high-lighted, and then using the UP and DOWN cursor keys to step the frequency in the desired direction. The ADJUST values change in STEP increments for the appropriate port. The KC Tuner will recalculate the required radio frequency, update the display window, and then update the radio. The window and radio updates will lag behind the cursor keypresses. The U and D keys may be used in this window to toggle the enablement of changes to the uplink (U) and downlink (D) radios. When a mic-click port is re-enabled the KC Tuner will assume the radio has been manually tuned to the correct current frequency. When a serial-port radio is re-enabled the radio will be sent a new frequency command when needed. While a satellite pass is active the F5 and F6 keys may be used to select the tabled satellite uplink frequency to be used. The F7 and F8 keys may be used to select the tabled satellite downlink frequency to be used. Radios on serial-interfaces will be retuned to the new frequency selected. mic-click-interface radios must be retuned to the frequency shown on the ACTIVE window. Press F1 for help. The ACTIVE window can be closed by pressing <ESC>.

From the ACTIVE window you can move to the ADD window by pressing F3. This window is used to add satellite information to the satellite database. Satellite name and beacon frequency must be supplied. If you don't want to tune the uplink or downlink for this satellite, just hit enter when the PORT/VFO field is requested. The satellite's name must be entered exactly as it is provided by the tracking program used. Enter the desired parameter values, pressing ENTER to save each field. Changes made to this window will be saved to the satellite parameter database the next time an application program makes a DOS call. Press F1 for help. Use <ESC> to return to the ACTIVE window.

From the ACTIVE window you can move to the CHANGE window by pressing F4. This window is used to change satellite information in the satellite database. Use the cursor UP and DOWN arrows to select the satellite you wish to change. Use the TAB key to move among the fields. To change a field use TAB to highlight the field, enter the new value, and press ENTER. If you change the satellite's name, a new database entry for the new name (and any other changed parameters) is created. The old entry with the old name will not be deleted. Changes made to this window will be saved to the satellite parameter database the next time an application program makes a DOS call. Press F1 for help. Use <ESC> to return to the ACTIVE window.

Finally, from the ACTIVE window you can move to the DELETE window by pressing F9. This window is used to delete satellites from the satellite database. Use the cursor UP and DOWN arrows to select the satellite you wish to delete. Press ENTER to delete the selected satellite. ~~You may not delete an active satellite.~~ Changes made to this window will be saved to the satellite parameter database the next time an application program makes a DOS call. Press F1 for help. Use <ESC> to abort the delete function and return to the ACTIVE window.

7.1 Window Fields

Each of the windows displays some if not all of the following fields. Each of these fields can be defined and changed by the operator

Uplink Status (OFF/ON)
This field is in the box in the upper right corner of the tuner status window. The KC Tuner is allowed to make frequency changes to the uplink radio when this field is ON. When this field is OFF no changes will be sent to the radio. This field can be toggled using the U key from the ACTIVE window.

Downlink Status (OFF/ON)
This field is in the box in the upper right corner of the tuner status window. The KC Tuner is allowed to make frequency changes to the downlink radio when this field is ON. When this field is OFF no changes will be sent to the radio. This field can be toggled using the D key from the ACTIVE window.

Satellite Name
This 8-character field appears below the date and above the "Beacon" legend on the left side of the Tuner window. It is set to the name of the satellite currently being referenced by the current window. When no satellite pass is active the satellite name field on the ACTIVE window is set to INACTIVE. The satellite name must match the name-information provided by the tracking program. If a satellite pass begins for a satellite not in the satellite parameter database, the name will appear in the active window with question marks in the real frequency fields.

Antenna Selector
The "ANT=" field appears just below the version# on the window. When prompted for this value you can enter nothing or the numeric values 0 to 4. This field is used to control 2 latched bits on the PC interface card. These latched bits can be used to control equipment (antenna relays, etc.) in your shack. Call for more information if you are interested in this field and have the technical expertise needed to use these TTL outputs.

Real Beacon Frequency
The real beacon frequency is the frequency on which the satellite sends its beacon. This field does not have to match the satellite beacon frequency itself so much as it must match the beacon frequency in the Keplerian parameters used by the tracking program. In other words, you can tell the KC Tuner that the beacon frequency is 100mhz even if the beacon frequency is really 435.91mhz if the tracking program also thinks the beacon frequency is 100mhz.

Shifted Beacon Frequency

This field is only displayed on the ACTIVE window during a satellite pass. It is the dynamic result of the KC Tuner's interpolation of the satellite pass information stored in the driver's tables.

Uplink Port/VFO

This two character field defines the radio-control-port and VFO to be used for this satellite's uplink. The radio connected to the specified port must be capable of tuning to the uplink's frequency range. If no uplink tuning is needed for this satellite, press ENTER at the field prompt. The first character of the field is the port identifier. If specified it should be in the range of the letters A to D (A & B are serial ports, C & D are mic-click ports). The second letter of the field is the VFO identifier. The VFO identifier is ignored on mic-click ports. For Yaesu radios and the Kenwood TS-790 the uplink VFO need not be specified; it will be forced to "A". The KC Tuner serial interface does not support VFO numbers on Icom radios. The VFO number will default to "A" unless specified for Kenwood serial- interface radios.

Uplink Mode

The uplink mode contains the uplink transmission mode. Legal entries include: CW, AM, FM, USB, LSB, SSB, FMN, CWN. The "N" suffix on FMN and CWN indicate narrow-band. Not all modes indicated here are supported by all radios. While the mode is not pertinent to mic-click ports, a dummy parameter must be supplied.

Real Uplink Frequency

This field displays the nominal uplink frequency. It is used to calculate the needed frequency offset and must be set with an accurate value if the uplink is to be tuned correctly.

Uplink ADJUST value

This field can only be changed in the ACTIVE window during a satellite pass. It supplies a number that the KC Tuner adds (internally) to the real uplink frequency before beginning to compute the shifted uplink frequency. It is difficult to judge how useful this field really is, as it is almost impossible to determine how well the satellite is receiving your signal. Without other information to the contrary this field should be left set to 0.

Shifted Uplink Frequency

This field is only displayed on the ACTIVE window during a satellite pass. The value displayed here is the computed uplink frequency. The value is always aligned to the nearest step boundary. The frequency shown on the uplink radio should match this display.

Downlink Port/VFO
This two character field defines the radio-control-port and VFO to be used for this satellite's downlink. The radio connected to the specified port must be capable of tuning to the downlink's frequency range. If no downlink tuning is needed for this satellite, press ENTER at the field prompt. The first character of the field is the port identifier. If specified it should be in the range of the letters A to D (A & B are serial ports, C & D are mic-click ports). The second letter of the field is the VFO identifier. The VFO identifier is ignored on mic-click ports. For Yaesu radios and the Kenwood TS-790 the downlink VFO need not be specified; it will be forced to "B". The KC Tuner serial interface does not support VFO numbers on Icom radios. The VFO number will default to "A" unless specified for Kenwood serial- interface radios.

Downlink Mode
The downlink mode contains the downlink transmission mode. Legal entries include: CW, AM, FM, USB, LSB, SSB, FMN, CWN. The "N" suffix on FMN and CWN indicate narrow-band. Not all modes indicated here are supported by all radios. While the mode is not pertinent to mic-click ports, a dummy parameter must be supplied.

Real Downlink Frequency
This field displays the nominal downlink frequency. It is used to calculate the needed frequency offset and must be set with an accurate value if the downlink is to be tuned correctly.

Downlink ADJUST value
This field can only be changed in the ACTIVE window during a satellite pass. It supplies a number that the KC Tuner adds (internally) to the real downlink frequency before beginning to compute the shifted downlink frequency. This compensation ability is needed for sideband work, and is also useful for tuning out minor frequency variations caused by variations in altitude, latitude, longitude, time, atmospheric propogation effects, etc. For sideband work this value should be set to (roughly) the (+ for USB, - for LSB) average AFSK frequency used (mark-freq + space-freq / 2).

Shifted Downlink Frequency
This field is only displayed on the ACTIVE window during a satellite pass. The value displayed here is the computed downlink frequency. The value is always aligned to the nearest step boundary. The frequency shown on the downlink radio should match this display.

Appendix A: LLG02 connector pinout and output options

PIN	DESCRIPTION
1	Ground
3	Up control output
5	Down control output
6	Ground
7	Right control output
8	Azimuth brake release
9	Left control output
10	Port-A Serial Input
11	Vertical analog input
12	Port-B Serial Input
13	Horizontal analog input
14	Regulated -12vdc from the PC's power supply
15	Ground
16	Ground
17	Ground
18	Port-A Serial Output
19	Regulated +5vdc from the A-to-D converter's regulator
20	Port-B Serial Output
21	Regulated +12vdc from the PC's power supply
22	Port-C Click-Down
23	Port-C Click-Up
24	Port-D Click-Down
25	Port-D Click-Up

NOTE: The +5vdc A-to-D regulator output is provided for use in applications using the Rotor Interface Option. This use should not use more than 10ma. Use of this output for other purposes is discouraged because a) the +5vdc regulator has no heatsink and may overheat and b) varying the load on this supply will reduce the accuracy of the position-sending hardware.

KC Tuner Output Options: Most radios available today with serial computer control ports have TTL-level (0-5v) inputs and outputs. The radio's manufacturer then provides a fairly expensive accessory that is used to convert the TTL-level voltages to RS232-level voltages (-12 to +12). The LLG02 board, when purchased with the serial KC Tuner option, has an option on the serial output voltage levels. The board comes to you from us populated with RS232 level-converter ICs. We also provide two header plugs (IC-shaped component carriers) with two jumpers on each plug.

If your radio has TTL-level outputs, you can replace the level-converter ICs with the supplied header plugs and connect the KC Tuner directly to your radios, eliminating the need for the manufacturer's level converters. Note that these header plugs convert both port A and B to TTL levels - you can not have one port at TTL levels and one at RS232 levels.

The header plug that replaces the LM1488 has jumpers between pins 2 and 3, and between pins 5 and 6. The header plug that replaces the LM1489 has jumpers between pins 1 and 3, and between pins 4 and 6. ICs are numbered counter-clockwise when viewed from the top, with pin 1 always in the corner marked with a dot, notch, or beveled side.

Parts Placement on LLG02 board

Component-Side View

```
-----------------------------------------------------------------
|                                                               |
|          _____________         ________     _________        |
|   _____ |             |       | LM1488 |   |   |     |----    |
|  |Xtal ||    2651     |      o|________|   | O |7805T|----    |  ----
|  |Osc  |o|____________|        ________    |___|_____|----    |  |
|  |_____| _____________       :  "B"   :                       |  |
|         |             |      o________:   :  "C"    :  -------  |
|         |    2651     |                   o_________: |  O      |
|        o|_____________|     ____________              |       ---
|                            |            |             | 25       |
|                            |  ADC0809   |             | P i n    |
|                           o|____________|             | Connect- |
|                                                       |      -or |
|                                                       |          |
|                + More ICs here!                       |          |
|                                                       |       ---
|    Component Side                                     |  O      |
|                                                        -------  |
---------------------------------                        ----    |
                                 | | | | | | | | | | | | | | |    |
                                 | | | | | | | | | | | | | | |
                                 -----------------------------
```

NOTE: The LM1489 is located in the location marked "B" on the LLG-02B version boards, and in the location marked "C" on the LLG-02C version boards.

Card-Edge Connector, with gold-plated "fingers"

Header Plugs Used To Replace RS-232 Level Converters, Providing TTL-level outputs.

```
Replaces 1488                   Replaces 1489
(Top View)                       (Top View)

-O-O-O-O-O-O-O-                 -O-O-O-O-O-O-O-
|             |                 |             |
|   _     _   |                 | ___   ___   |
|  | |   | |  |                 ||   | |   |  |
\O-X-X-O-X-X-O-                 \X-O-X-X-O-X-O-

^                               ^
|                               |
\------ Beveled Corners--------/
```

Appendix B: Connecting to ICOM radios

CI-V Serial Interface:
The KC Tuner is fully compatible with Icom's CI-V serial interface. You can connect the KC Tuner directly to your radio at TTL levels, or pay Icom about $100 so you can connect at RS-232 levels through Icom's CT-17 Level Converter. The CT-17 is actually a hindrance, since it mixes the control signals, and we STRONGLY recommend you run separate lines from the KC Tuner to each radio. Bottom line: Don't buy the CT-17. If you have one, use it for a wall decoration.

Switches 7 and 8 on the right dipswitch pack (viewed component side toward you, gold-plated edge-connector down) control inversion of the port A and port B serial ports. ICOM radios require non-inverted signals when using TTL-level signals. If port A will be connected at TTL levels to an Icom radio, set switch 7 ON (may be labeled "CLOSED"). If port B will be connected at TTL levels to an Icom radio, set switch 8 ON.

The CI-V interface is based on a 1/8-inch headphone plug, readily available from Radio Shack. Run shielded wire from this plug to the 25-pin connector on the KC Tuner interface card. The shield should go to a ground pin. The center wire should go to pin 10 and 18 (Port A) or to pin 12 and 20 (Port B). Remove the RS-232 level converter IC's from the interface card and replace them with the header-plugs supplied with the KC Tuner. Push the plug into the CI-V interface connector on your radio and you are ready to go! NOTE: The KC Tuner only supports the CI-V interface at 1200 baud. This speed is the factory default setting. If your radio's serial-speed has been changed, return it to 1200 baud.

CI-IV Parallel Interface:
Icom has built a family of radios supporting a parallel interface. These radios include the IC-R71A, IC-271A, IC-271H, IC-471A, IC-471H IC-751, IC-751A, and IC-1271A. The KC Tuner was not designed to support parallel interfaces. Icom has announced a converter called the UX-14 that can convert from CI-IV (parallel) format to CI-V (serial) format. We recommend to our customers with parallel-interface radios that they purchase the UX-14 converter and use the serial interface format described above. As described above, set the UX-14's serial speed to 1200 baud. Set the "Transceive" switch ON.

The Icom Mic-Click interface:

Icom's mic-click interface is very simple to implement. You'll need a 470-ohm 1/4-watt resistor and a matching mic connector.

```
KC Tuner                                                 Radio's Mic
25-Pin                                                    Connector
Connector


23 (Port C) or  <-UP---------------------------o----> Pin 3 (up/down)
25 (Port D)                                    |
                                               |
                      ______________           |
22 (Port C) or  <-DOWN-| 470-ohm 1/4w |----'
24 (Port D)           |______________|


1  (Ground)     <---------------------------------->  Pin 6 (Ground)
```

Appendix C: Connecting to Yaesu Radios

CAT Serial Interface (736):

This interface is fairly simple to connect. You'll need a 6-pin DIN connector that matches the connector on your radio. Note that while you can buy the serial TTL-to-RS232 level converter from Yaesu, we don't recommend it as it is a needless expense. Switches 7 and 8 on the right dipswitch pack (viewed component side toward you, gold-plated edge-connector down) control inversion of the port A and port B serial ports. Yaesu radios require non-inverted signals when using TTL-level signals. If port A will be connected at TTL levels to a Yaesu radio, set switch 7 ON (may be labeled "CLOSED"). If port B will be connected at TTL levels to a Yaesu radio, set switch 8 ON. The following connection diagram assumes you are connecting your KC Tuner directly to your radio.

KC Tuner 25-Pin Connector		Radio Connector
1 (Ground)	<----------------------------------->	Pin 1 (Ground)
10 (Port A) 12 (Port B)	<----------------------------------->	Pin 2 (RX Data)
18 (Port A) 20 (Port B)	<----------------------------------->	Pin 3 (TX Data)
	Not Connected -------->	Pin 4 (BUSY)
	-------->	Pin 5 (Not Used)
	-------->	Pin 6 (Not Used)

Mic-Click (726R):

For this interface you'll need a matching mic connector and two 2.7k 1/4-watt resistors. The 726 mic-click interface lines are active high. After a reset the KC Tuner mic-click control outputs are high until the KC Tuner is loaded into memory. For this reason, you should expect to see your radio's frequency "run away" when you re-boot your PC and before you load the KC Tuner into memory. For this reason, most 726 users disconnect the mic-click connector from the radio when the KC Tuner is not in use.

```
KC Tuner                                             Radio's Mic
25-Pin                                                Connector
Connector

23 (Port C) or  <-UP-o-----------------------------> Up
25 (Port D)          |
                     \--- | 2700-ohm 1/4w |
                          |_______________|--\
                                             |------> +5vdc from
                                             |        radio (Pin 2)
                       /---| 2700-ohm 1/4w | |
                       |   |_______________|-/
                       |
22 (Port C) or  <-DOWN-o---------------------------> Up
24 (Port D)

1  (Ground)     <----------------------------------->  Ground
```

Appendix D: Connecting to Kenwood TS-711/811

Connecting to the Kenwood IF-10A/IF-10B serial interface adapters:
There is no need to purchase Kenwood's TTL-to-RS232 level converter, as the IF-10A/B serial interface's output levels are at TTL levels. Switches 7 and 8 on the right dipswitch pack (viewed component side toward you, gold-plated edge-connector down) control inversion of the port A and port B serial ports. Kenwood radios require inverted signals when using TTL-level signals. If port A will be connected at TTL levels to a Kenwood radio, set switch 7 OFF (may be labeled "OPEN"). If port B will be connected at TTL levels to a Kenwood radio, set switch 8 OFF.

The following connect-chart assumes you want to connect the KC Tuner directly to the IF-10A/B serial interface.

```
KC Tuner                                              Radio's IF-10
25-Pin                                               DIN Connector
Connector

18 (Port A) or  >-----------------------------------> RXD (Pin 3)
20 (Port B)

10 (Port A) or  <-----------------------------------< TXD (Pin 2)
12 (Port B)

19 (+5vdc)      <-----------------------------------> CTS (Pin 4)
                                   Not Used -------< RTS (Pin 5)

1  (Ground)     <-----------------------------------> GND (Pin 1)
```

Connecting to a Kenwood radio via the mic-click interface:
Kenwood radios can be directly connected to the KC Tuner mic-click ports. No pull-up resistors are needed.

```
KC Tuner                                             Radio's Mic
25-Pin                                               Connector
Connector


23 (Port C) or  <-UP-------------------------------> Up
25 (Port D)                                          (Pin 4)


22 (Port C) or  <-DOWN-----------------------------> Down
24 (Port D)                                          (Pin 3)


1  (Ground)     <----------------------------------> Ground (Pin 8)
```